Endogenous Nicotinamide Adenine Dinucleotide Fluorescence During Irrigated RF Ablation: A Novel Strategy To Identify Lesion Gaps

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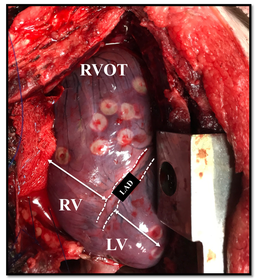
Introduction

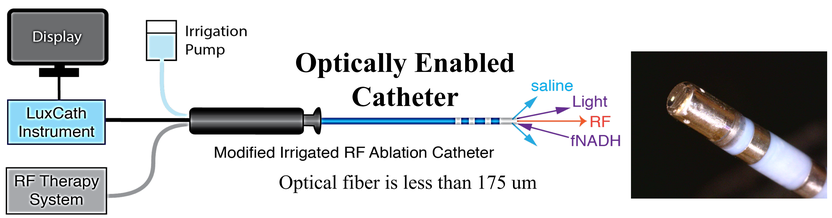
- Inadvertent gaps are considered to be a common cause of failure of ablation for various arrhythmias.
- The loss of endogenous fluorescence of nicotinamide adenine dinucleotide (NADH) can serve as a marker of myocardial viability and thus of myocardial ablation.
- The objective of our study was to assess the ability of a novel irrigated catheter that is able to detect endogenous NADH fluorescence as an approach to detect gaps between adjacent ablation lesions.

Methods

- Midline sternotomy was performed in a single swine under general anesthesia. A 3.5mm tip irrigated radiofrequency (RF) ablation catheter was used to make discrete but adjacent lesions on the epicardial surface of the beating heart.
- A total of 7 (diameter 8.1±1.1 mm) and 5 (9.8±1.2 mm) lesions were created with varying inter-lesion gaps over the RV and LV epicardial surfaces, respectively.

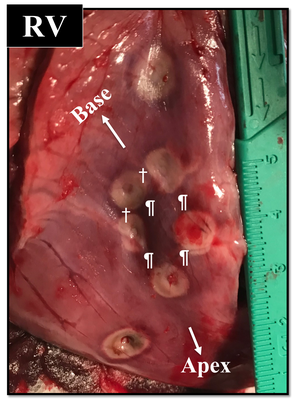


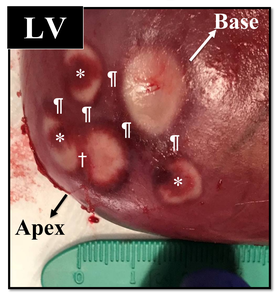
- The operator, blinded to the NADH signals, moved the optically enabled catheter across and between lesions while in contact with the epicardium.
- Two untrained observers, blinded to the surgical window/catheter location, informed with only a brief NADH mapping system overview assigned the catheter location to be either 'Lesion' or 'Normal Myocardium' based only on real-time NADH fluorescence signals.
- Concordant interpretations between the two observers led to the site being classified as 'Determinant' and discordant interpretations were assigned as 'Indeterminant'.



Results

Distribution of Lesions and Gaps

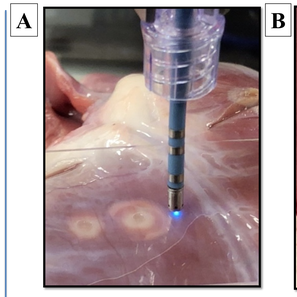


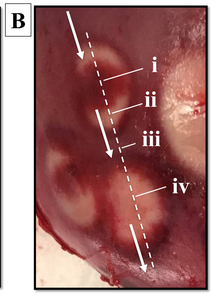


† Gap (1.0-1.3 mm)
¶ Gap (3.6-6.5 mm)
* Surface sparing

3/5 LV lesions demonstrated some surface sparing at the center of the lesions (core).

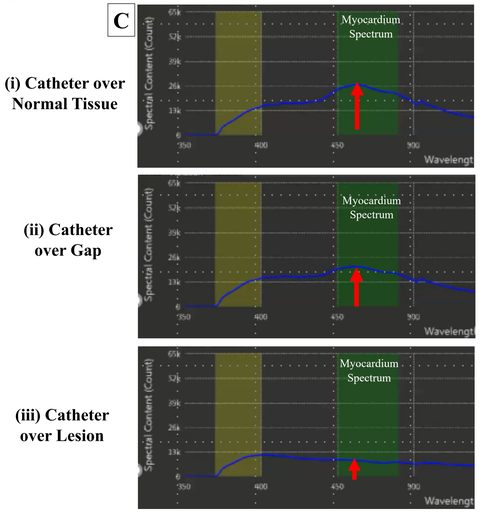
NADH Mapping of Lesions and Gaps



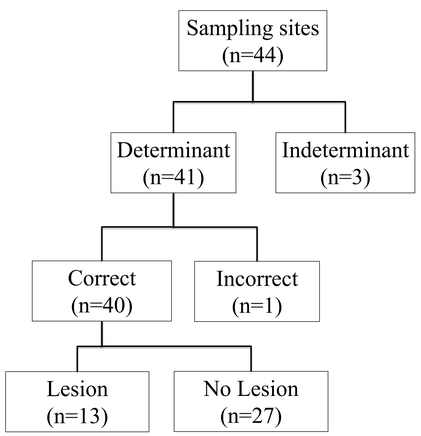


A. Fluoresced light (blue) was used to visually identify the location of the catheter tip.

B. Zoomed view demonstrating representative path of the optically enabled catheter tip while assessing tissue with epicardial contact. Lesion and gap locations correspond to NADH profiles on Panel C.



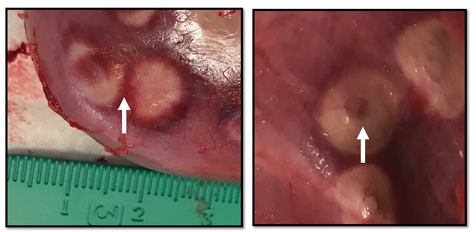
C. The amplitude of the myocardium spectrum↑ was greater over areas of normal tissue (i & ii) (sparing or gaps) than over lesions (iii).



Predictions Based on NADH Fluorescence Signal

	Normal Tissue Identification	Lesion Identification	Gap Identification	Overall
Number of sites	11	15	18	44
Prediction rate	**100%**	**87%**	**89%**	**91%**
Correct	11/11	13/15	16/18	40/44
Incorrect	0/11	1/15	0/18	1/44
Indeterminate	0/11	1/15	2/18	3/44

Indeterminate Sites 3/44



The three instances of indeterminate assignment occurred at two lesion gap sites and one lesion core site.

Conclusions

The ability to measure endogenous NADH fluorescence allows for identification of gaps between ablation lesions. The spectral profile of ablated versus unablated tissue is therefore a suitable target that can be used to improve RF ablation outcomes.

Disclosures: J.S. Koruth - Research Grants. V.Y. Reddy – Consultant/Stock Options. T. Ransbury, C. Larson, KC Armstrong – Employee/Contractor. Others-None